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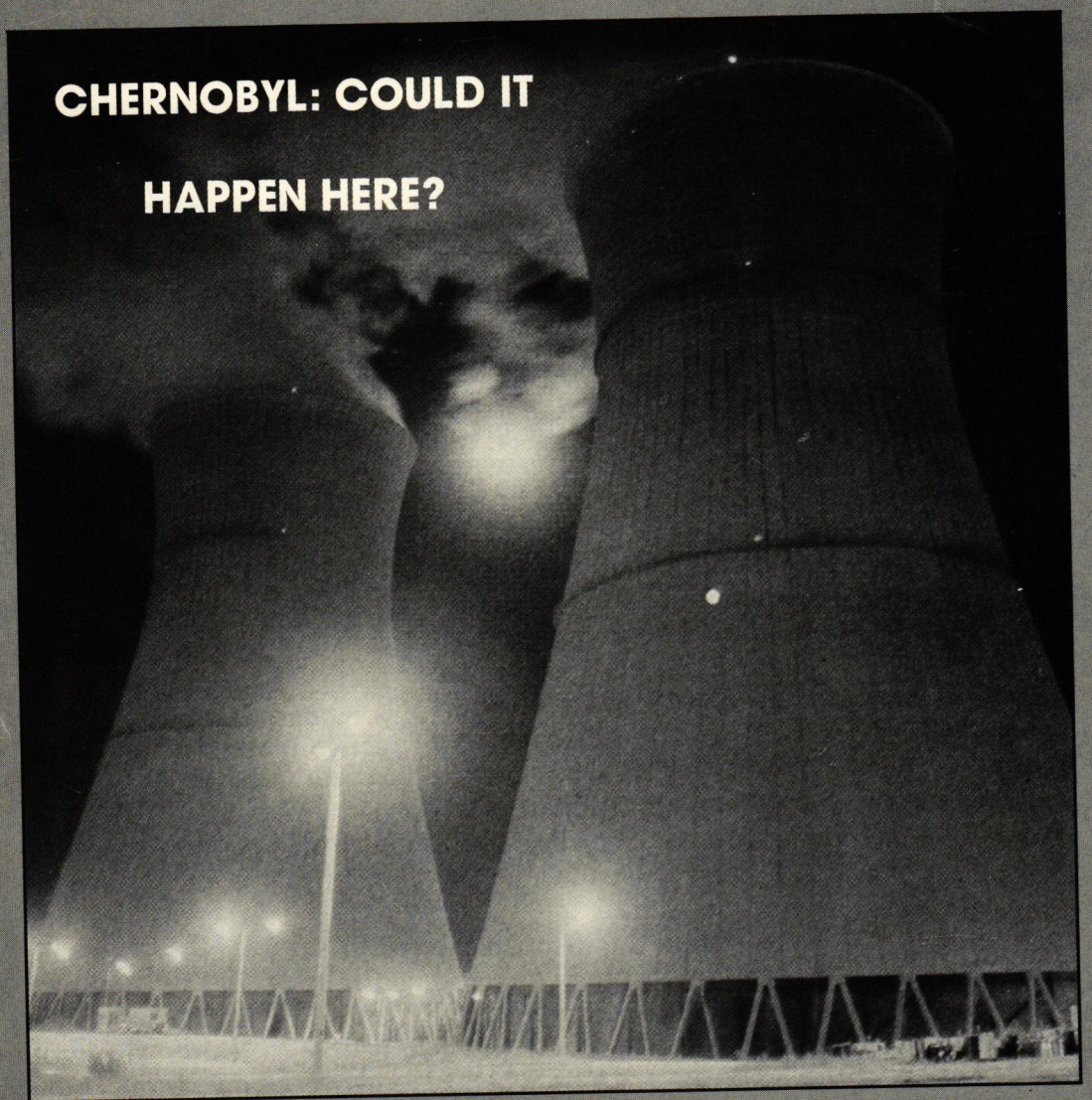
MECHELECIV



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Established 1942

"Nuclearphobia": Have You Got It?

by Rose Province

The accident at Chernobyl has brought the issue of nuclear power once more into public view. But is it a real threat or have we become "nuclearphobic"? **6**

Rain of Trouble: Acid Rain Menaces the Environment

by April Stokes

Hundreds of lakes in upstate New York have no fish population, due to acid rain. Can legislation be passed to control emissions or will this "rain of trouble" continue to destroy the nation's wildlife? **10**

COVER: The Rancho Seco nuclear reactor outside of Sacramento, California is one of 101 operating nuclear plants in the U.S. It takes 8 to 10 years to build a plant in this country because of the extensive safety regulations. Courtesy of US News and World Report.

"Warning . . . Keep Out!": Storing and Disposing of Hazardous Wastes

by Swati Patel and Lilimar Z. Avelino

The incidents at Love Canal and Times Beach have alerted us to the perils of toxic waste spills. Now, thanks to the efforts of environmental coordinators like Thomas Woo, precautions can be taken to guard against contamination of the air and water so vital to human health. **13**

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Playing With Fire

"PICTURES have reached us from the Soviet Union lately—pictures the likes of which we haven't seen for more than 40 years. These photographs are vivid evidence of the horrible suffering that can be inflicted on human beings by nuclear radiation. Not since the bombings of Hiroshima and Nagasaki do so many people stand to be affected by the nightmares of cancer, birth defects, and physical scarring which accompany it. Chernobyl, however, was not a result of deliberate malicious use of this terrific power. Rather, it was an example of how careless handling of it let it get out of control, initiating a deadly sequence of events.

Engineers and technicians at the Chernobyl nuclear plant had merely wanted to perform a routine test. As is often done, they elected to take it one step at a time, not necessarily anticipating possible consequences of their actions. It was when they tried to correct for their mistakes that their strategy back-fired, creating a snowballing sequence of breakdowns. In their attempts to bring the crisis to a halt, they went further and further down the road to disaster.

Nor were they aided by the lack of enough protective concrete around the reactor. One can argue that the extraordinary barrage of regulations regarding the shielding of reactors in this country is too complex and inhibits new plant construction. Nonetheless, they are intended to preserve public safety. The Soviets appear to have shown much less concern for such safety when they built Chernobyl.

In this issue, we will explore many of the more dangerous environmental effects of technology. Rose Province discusses the Chernobyl incident, in its own context and in the context of reactors in the U.S. She was fortunate to be able to discuss this with Dr. Harold Denton of the Nuclear Regulatory Commission (NRC), who has recently returned from the international conference in Vienna, discussing the Chernobyl disaster. April Stokes writes about the problem of acid rain, a scourge that is rapidly laying waste to our nation's forests and lakes. Swati Patel and Lilimar Avelino explore ways of disposing of hazardous wastes, without triggering spills, as happened at Love Canal or Times Beach.

Could Chernobyl have happened here? It is true that the battery of safety regulations which must be met for nuclear plant construction in the U.S. are intended to insure the utmost safety in their operation. But as Three Mile Island so clearly demonstrated, just a few years ago, no plant is immune to failure. Short of abandoning nuclear power altogether, the only alternatives are rigorous care in design and dutiful attention in operation. The possibility for disaster is always there, but we must aim to reduce it to an extremely remote one. Or else, as Chernobyl showed, we are really playing with fire.

Daniel L. Briller
Editor-in-Chief

PROTECTING

South African Sanctions May Damage US Industry

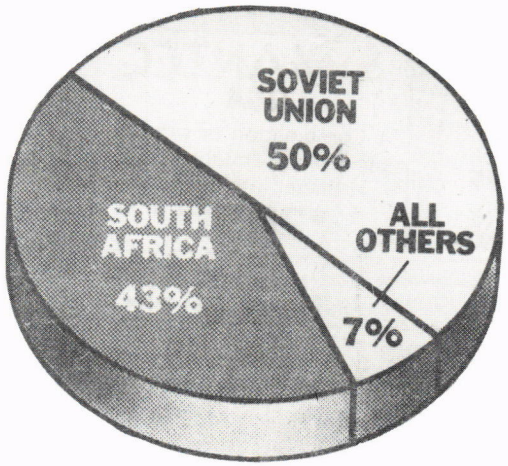
"WOULD economic sanctions effectively persuade South Africa to abolish its system of racial apartheid? Many prominent statesmen and members of Congress now strongly support them. Political and moral ideologies aside, though, some very real consequences of a trade embargo with South Africa must be considered. Perhaps the most crucial is that the U.S. serious ly depends on South Africa for some rare strategic metals—the only other major supplier of which happens to be the Soviet Union.

In many respects, the United States is a mineral-rich nation. However, certain rare, but critical, metals are not found within its borders. Currently, our country imports 73 percent of all the chromium it needs, 100 percent of all manganese, 92 percent of all platinum-group metals, and 95 percent of all cobalt. Each of these metals is vital to a particular industry: examples being steel, automotive, plastics, petroleum, and chemical.

Chromium is a metal essential for the production of stainless steel. Every engine on an F-15 fighter plane contains about 1, 600 pounds of it. U.S. yearly requirements for chromium are expected to double by the year 2000.

Manganese and cobalt are two elements also crucial to the functioning of the U.S. steel industry. Manganese is traditional ly used to strengthen and toughen steels for auto engines and heavy machinery. Cobalt, likewise, plays a vital role in the manufacture of high-strength, high-temperature superalloys that go into jet engines.

Platinum is a very rare element, but one needed by many different industries. It is an important catalyst in many chemical reactions, including those that produce gasoline, fertilizers, and plastics. Medically, it turns up in bone implants and in **cisplatin**, an anti-cancer drug. It is also found in the catalytic converters installed in automobiles to control pollution.



The Soviet Union and South Africa together hold 93 percent of the world's known platinum reserves. Platinum is crucial for manufacturing, among other things, the catalytic converters that control pollution in automobiles. Courtesy of The New York Times.

According to statistics published in 1985, the U.S. imported 55 percent of its chromium, 39 percent of its manganese, and 49 percent of its platinum-group metals from South Africa. But, as mentioned before, the situation is exacerbated by Nature's way of very selectively depositing these minerals on Earth. For example, the nations of Zimbabwe and South Africa together hold 99 percent of the world's known chromium deposits. As shown in the diagram, the Soviet Union and South Africa combined hold 93 percent of the world's platinum reserves. In the event of superpower hostilities or disagreements, the Soviet Union could not be relied upon for shipments of platinum. There are more unhappy facts: together, the Soviet Union and South Africa hold 95 percent of the world's vanadium and 94 percent of the world's manganese.

"WHAT could be done in the event of a complete stoppage of mineral imports from South Africa? Four alternatives being considered are stockpiling and recycling, new refining techniques, mining the ocean floor, and modifications in existing technologies which use these metals.

The U.S. government has, for many years, maintained a stockpile of strategic metals for use in wartime or other emergencies. National policy, as of 1985, mandated keeping a minimum supply of one year's worth of imports of all critical minerals. However, the Reagan Administration has more recently favored a policy of *selling* strategic metals to help reduce the national debt. Critics argue that, at the present time, this may not be the best idea. Simon D. Strauss, a former government advisor on strategic metals, warns that "the U.S. is considerably less self-sufficient in minerals than it was 40 years ago." He goes on to say that if another crisis arises, as it did during World War II, the Administration might come to regret its "stockpile liquidation mania."

In many cases, strategic metals can be recycled from industr ial

scrap. Platinum, for example, can be retrieved from spent nuclear fuel or from the cannibalized catalytic converters of cars. In fact, the U.S. now recovers 10 percent of its yearly platinum supply from junked autos. Cobalt, too, might be recovered from used jet engine parts. It should be noted, though, that most of the recycling processes being considered are not economically feasible at this time.

New refining methods are available that can reduce the demand for some of these minerals. One plant in Montana has a smelter which can produce **chromite**, a substitute for chromium. The problem with this plant is it is hardly energy efficient, consuming one *million* watts of electricity per *hour*.

Two more alternatives suggested are substitution of other raw materials and mining the ocean floor. Advanced ceramic parts are starting to be used in gas turbine and auto engines. Nickel or molybdenum might be substituted for chromium in steel alloying, if shortages become grim. Perhaps a more promising option involves the mining of potato-shaped mineral nodules from the ocean floors. Large deposits of cobalt, manganese, and platinum have been discovered in rocky shelves off of Hawaii and Florida. So far, though, the U.S. has lagged behind other nations in developing this technology, mostly because of the cheap and available supplies of metals on the international market.

One other key question to ask at this point is, "will South Africa cut off shipments in the event stiff American sanctions are passed?" As of last year, three-fourths of all South Africa's foreign exchange came from metals sales. There is also growing competition from countries like Zimbabwe, Australia, Brazil, and Turkey. Nonetheless, a complete embargo would almost certainly force the U.S. to explore other sources, which is why that work must be started now. Federal subsidies for developing alternate technologies would be a strong move toward making us more self-sufficient in this area.

—Daniel L. Briller

Scientists Puzzled and Concerned over "Hole In The Sky"

IN 1985, a team of British scientists working in Antartica made a startling discovery. They found a hemorrhage in the ozone layer over the South Pole, literally a hole in the sky. The hole has since been found to have existed from 1979, expanding each year to encompass an area the size of the United States.

Ozone is made of three atoms of oxygen and is very unstable. It is essential to life on Earth, for it blocks off much of the ultraviolet radiation from the sun that would cause skin cancer in humans, kill aquatic life, and damage crops. Because of the extreme importance of the ozone layer, a group of scientists headed by Susan Soloman are at the South Pole searching for evidence to study this potentially dangerous hole.

Due to the lack of evidence, a whirlwind of theories have been put forth which range from the hole being a transient, natural phenomenon to it being a long ranging, man-made phenomenon.

One explanation supporting a natural phenomenon is that the hole is caused by cyclical atmospheric processes. Some meteorologists believe that since the South Pole is the coldest place on Earth, normal dynamical movement of waves or cyclones in the upper atmosphere could cause the hole. Other theories, upholding a natural phenomenon, believe the cause to be volcanic particles or solar activity. Dr. Jerry Mahhlman, Director of the Geophysical Fluid Dynamics Laboratory, favors the dynamical theory but also believes that there is very little evidence backing up any proposed theories; in his words, the evidence is, "somewhere between miniscule and non-existent."

Dr.McElroy of Harvard, on the other hand, supports the chemical theories. His own proposal is that the breakdown is caused by chlorine and the rare gas bromine. Bromine is used in specialized fire extinguishing equipment, and, Dr.McElroy believes, it could, in small amounts, cause a large amount of ozone depletion. Another proposal, made by Susan Soloman and supporting a chemical theory, relies on a complicated series of chain reactions caused by sunlight and chlorine atoms.

None of these theories are completely acceptable because of the lack of evidence. Since each theory makes a specific prediction of the polar atmosphere, each can be tested. The expedition to the South Pole should be able to prove many of these wrong and hopefully find the right cause.

—Vaiji Ramaswami

Rejuvenated Statue of Liberty Reopens in New York

"GIVE me your tired, your poor, your huddled masses yearning to breathe free . . ." To the millions of immigrants entering this country at the turn of the century, she was more than a "new colossus"; she was an idea, a promise, a symbol of freedom, opportunity, and hope. Impoverished crowds stood all night on the decks, straining to capture the first glimpse of her. Now, after a two-year restoration, the 100 year-old Statue of Liberty once again stands ready to welcome and guide new generations to our shores.

It was a festival unparalleled in the recent history of our nation. Millions jammed New York City to witness the official reopening on the weekend of July 4th, 1986. Tall ships and naval flotillas paraded down New York Harbor, bands played, and fireworks and laser light illuminated the night sky.

Presidents Ronald Reagan of the U.S. and Francois Mitterand of France (the Statue was originally a gift from France) were on hand to participate in and direct the ceremonies. All of this climaxed a renovation period that took two years and 31 million dollars to complete. Miss Liberty will enter her second century structurally sound, accommodating for visitors, and aesthetically as beautiful and awe-inspiring as ever.

But in 1984, this was all a long way off. The brilliant creation of sculptor Frederic Bartholdi and engineer Gustave Eiffel (also designer of the Eiffel Tower) was old, worn, and creaking. The decision was to perform extensive structural and aesthetic restoration, to be finished by 1986, the Statue's one-hundredth birthday.

The 151-foot tall Statue is supported by a system of structu ral bars and girders, invisible from the outside. Sheets of copper, as thin as a penny in places, are hung from this framewo rk and form the skin. Originally, the 1, 799 structural bars were made of iron. Over the years, the difference in galvanic potential between iron and copper had brought about serious corrosion in the bars. As a result, all of them were replaced with stainless steel equivalents.

The raised arm holding the torch had suffered, too, from corrosion caused by rainwater dripping down on it. This weakening was exacerbated by a peculiarity in design—namely, to make the Statue more aesthetically pleasing, Bartholdi had gone against Eiffel's advice and moved the arm from its point of strongest support. Additional buttressing in the area of the shoulder thus had to be provided.

The torch, itself, had suffered so much from corrosion that it was decided a new one would have to be built. American officials turned to France, looking for artisans skilled in the ancient art of **repousse**. **Repousse**, the technique Bartholdi himself had used, consists of hammering on the reverse side of the copper sheets until they are thin enough to form the shape of the sculpture. Twelve French craftsmen were brought overseas to work in New York for a year, constructing the new torch.

Be careful with that spike! French and American workmen replace one of the seven refurbished spikes of the Statue of Liberty's Crown. Courtesy of The New York Times.

The team began by studying old photographs of the torch. They then erected a wood-and-plaster mock-up, from which an iron mold could be made. Thin copper sheets were then riveted to the mold, and the flame was covered with gleaming, 24-karat gold leaf.

In addition to structural strengthening, Miss Liberty underwent a complete cosmetic facelift. Layers of old paint and tar were blasted off with sprayings of bicarbonate of soda (at room temperature) and liquid nitrogen at -350 degrees Farenheit. Such unusual materials were necessary in order not to tear through the Statue's fragile skin. When the blasting was finished, the entire surface was repainted with a special water-and-zinc primer, invented by NASA.

Many new features were added to make Liberty more accessible and accommodating to visitors. For instance, the observation platform in the crown, and the stairway leading up to it, were widened and improved. A double-decked glass elevator was installed to carry visitors from the ground to the top of the pedestal (no passenger elevator can go up to the crown, due to the narrow confines of the interior). Even closed-circuit television cameras were put in at the base, so that people unable to climb the steps could still enjoy the spectacular panorama from the top.

No one will argue that the Statue of Liberty remains as glorious as ever atop her perch in New York Harbor. Again, in the words of Emma Lazarus, it is hoped that she will continue to "lift her lamp beside the Golden Door" for many years to come.

—Daniel L. Briller

■

"NUCLEARPHOBIA"—HAVE YOU GOT IT?

by Rose Province

"WHAT would you do if a nuclear power plant was about to be built near your home? Would you take up residence in another state—another country perhaps? Well, I wouldn't choose France, which gets 65 percent of its energy from the atom, the largest percentage in the world. As you might expect, French opinion overwhelmingly favors nuclear power. On the other hand, in the United States where nuclear power supplies 17 percent of our electricity, the public seems to be somewhat irrationally alarmed by the mere mention of anything nuclear.

Is there any basis for this fear? Here is a statistic which might surprise some people. In the U.S. alone, while 6,879 people have died mining coal since 1955, just 4 have been killed producing nuclear energy, and this does not take into account the thousands of victims of coal-fired air pollution. But of course, there are risks to nuclear energy as the Chernobyl catastrophe demonstrates.

WHAT IS NUCLEAR FISSION?

It all starts with the atom. Various numbers of protons and neutrons called "nucleons" are bound together by strong cohesive forces. There are also disruptive forces caused by electric repulsion between the protons. Thus, the nuclear stability is determined by the balance between these forces. This equilibrium is the reason why all matter in the universe has not released its energy in one giant atomic explosion.

Energy can be liberated by fusion in light nuclei and by fission in heavy nuclei. Fusion is just what it sounds like, the fusion of two small nuclei into a larger one. In fission, energy must be added to break the nucleus into two halves.

Nuclear fission is the reaction carried out in all nuclear power plants. Fission can be made efficient, because a self-sustaining chain reaction can be induced. The neutrons from one fission reaction may initiate other fission reactions, with a further release of fission energy, ideally until all the nuclear fuel (or fissionable material) is consumed.

For the fission reactions to continue once initiated, several conditions must be fulfilled. These conditions are achieved in a nuclear reactor with a moderator and control rods. A moderator is a material which slows down a neutron released by a fission reaction to the thermal energy at which it can cause further fission reactions. The power lever of a reactor, or the rate at which fission reactions can occur, can be controlled by inserting materials such as cadium (control rods), which absorbs neutrons. A reactor is called "critical" if each fission reaction produces one more, the other cases are "subcritical" and "supercritical." An extreme example of supercritical is an atom bomb.

Nuclear reactors can have many designs. They can differ in fuel (natural uranium, uranium enriched with uranium-235, or artificially produced fissionable materials), the moderator (water, graphite, beryllium), distribution of fuel within moderator (homogeneous, or nonhomogeneous), the energy of neutrons producing fission, and the heat exchanger (gas, water, or liquid metals).

WHAT HAPPENED AT CHERNOBYL?

The reactor at Chernobyl was a graphite one of antiquated design. This is a simple outline of how graphite moderated reactor works:
1) Atoms in rods of uranium split to release energy in the form of heat;
2) Water flows through tubes containing the rods of uranium, absorbs the heat, and becomes steam;
3) The steam turns the turbine;
4) which generates electricity.
Three long months after the explosion at the Chernobyl nuclear power plant, which spewed radioactive debris yards into the air, the Soviets are finally spelling out the events which led to the disaster.

The Soviets call them the six violations and they are as follows (as reported by the Washington Post, August 21, 1986): First, reserves of radioactivity at the reactor's core were dropped below permissable levels. Second, the power of the reactor was allowed to drop below the 700 megawatt level prescri bed for the tests. Third, during the experiment, all major circulating pumps were switched on, lowering the water levels with "drastic consequences."

Fourth, automatic blocking devices were shut off in an attempt to prevent the reactor from shutting down. These devices would have warned when steam was no longer reaching the turbine. Fifth, defense systems controlling water level and steam pressure were also blocked off. Finally, the emergency cooling system was shut off. Had it been operational, it would have been possible to localize the accident.

The big question on everyone's mind in the U.S. seems to be,

A Chernobyl fireman lies critically ill in a Moscow hospital. Severe doses of radiation can only be treated with complicated blood exchanges and bone marrow transplants. Courtesy of Life.

"could it happen here?" Experts have tried to give statistics, like the probability of a major accident here over twenty years is 45 percent. But others say there really is no basis for these numbers. Some insist that the fact of the matter is that accidents happen, and there is no perfect safeguard for human error or way to predict it. But there are ways to limit greatly the chance of human error, and the effect of a nuclear accident on the environment.

THE NUCLEAR REGULATORY COMMISSION (NRC)

I had the privilege to speak briefly with Dr. Harold Denton, the Director of Nuclear Reactor Regulation (NRR). The Office of NRR is responsible for regulating operating nuclear reactors, for reviewing applications for construction permits and operating licenses for new reactors, and for issuing such licenses after consideration by a number of boards and committees.

PLANT LICENSING

Denton told me a criticism of the NRC is that the body of regulations is too extensive. An application to the NRC for a license is about fifteen volumes long covering a very wide range of topics, including population density and physical characteris tics of the site: seismology, meteorology, geology, etc. Once a plant site was proposed in the middle of New York City, it was not licensed for obvious reasons.

A review is performed on the preliminary facility design encompassing safety components, anticipated response of the reactor to postulated operating scenarios and hypothetical accidents, proposed plans for conduct of plant operations, and much more. The review process takes 10-15 man-years, or two real years. The plant is then assigned an advisory committee, with members trained in various technical disciplines, which reviews each application. In addition, it is mandatory that a public hearing be held before a construction permit can be issued for a new plant.

According to Denton, it takes 8-10 years for a nuclear power plant to be built and inspected. Then, there is an extensive training program for operators, who must also be licensed. Finally, an NRC employee stays at the plant continuously to assure compliance with the commission regulations. The plants are fined if they do not comply.

RADIATION RUBBISH

The major problem with nuclear waste, Denton said, is finding a state which will take it. Even though the amount is small compared with other industrial wastes, no one wants it.

Radioactive wastes are separated into two broad classificati ons "high level wastes" and "low level wastes." High level wastes are of course more radioactive for a longer period of time than low level wastes. It is, for the most part, contained in used fuel, which is highly radioactive and requires shielding and remote handling. This waste is stored in specially designed, water-filled basins. Low level wastes are commonly buried in near surface shallow trenches, usually in the containers in which they are shipped.

The NRC has authority over storage and disposal of all commercially generated wastes and Department of Energy

Chernobyl Accident Threatens Grim Consequences for the Future

"THE Chernobyl nuclear reactor explosion is being considered to be one of the world's worst nuclear catastrophes. The reactor spewed out as much or even more radiation as that of the two atomic bombs dropped on Japan in World War II. The death toll stands at 31 and the critically injured by radiation sickness at 200. Experts estimate that over 5,000 people will die eventually due to cancer caused by radiation.

After months of silence,Soviet officials finally released the reasons for this disaster. On April 25,technicians at the Chernobyl reactor began to disconnect automatic shut down and warning systems to test how long steam-driven turbines at the plant would generate electricity in case of a the reactor's emergency cooling system but left the reactor operating at fifty percent power for nine hours. During this time,radioactive Xenon was building up in the reactor,reducing the power level and making the reactor more unstable. Because the power level was lowered, technicians removed most of the control rods and disconnected the automatic-rod control system to boost up the power level.

On April 26,the technicians began their experiment by shutting off valves that would steam to reach the turbine generating unit. They then bypassed the warning signal which would have caused the plant to shut down. As one U.S. expert put it, "The minute they started the test by shutting off the steam valves,their fate was sealed." The pumps in the plant power cutoff.

They began by shutting down began to slow down reducing the amount of cooling water sent to the reactor core. This caused heat and steam buildup which triggered a runaway reaction. Seconds later two explosions rocked the countryside and blew off the top of the Chernobyl reactor plant. The reactor's core was exposed to the air and began to burn intensely, spitting radioactive particles into the wind, which carried them for miles around.

The effects of the Chernobyl incident will still be felt for many years to come in the Soviet Union and its neighboring nations. Radioactive isotopes have contaminated the soil and water and rendered them useless. Many cattle have been affected by radiation and so are unsafe for human consumption. The total cost of Chernobyl is only now becoming clear.

—Vaiji Ramaswami

NRR Director Harold Denton (second from left) commented that if the Soviets had made changes at Chernobyl similar to those put in after Three Mile Island, the entire disaster might have been avoided. Courtesy of Dr. Denton.

generated wastes which are subject to long term storage and not used for research and development. The NRC is currently developing a new regulation and technical criteria for the disposal of high level waste.

INTERNATIONAL SCENE

When asked if the NRC is involved in any international control, Denton replied that there were no set regulations in international policy, but there is extensive interaction with first world countries such as France, Japan, and Sweden. Representatives from these countries meet with representatives from the NRC to exchange data. The regulations in these countri es are very similar to the U. S., in Denton's words "if you were plopped down in the middle of one (a nuclear power plant), you wouldn't be able to tell what country you were in."

Underdeveloped countries do not have many plants, but there are a few, for example Korea has an operating plant built by Westinghouse.

Denton left for Vienna, Austria where there is an international meeting with Soviet representatives currently in session at the writing of this article. The purpose of this meeting is to enable Soviet representatives to tell the world what actually went wrong in Chernobyl, so that we are able to learn from their mistakes.

When asked if he felt that what happened at Chernobyl could happen in the U.S., Denton responded that the NRC made a lot of changes after Three Mile Island (TMI) that the Soviets did not. If the Soviets had made similar changes, they could have possibly avoided the accident at Chernobyl. One million times the radiation leak that happened at TMI occurred at Chernobyl because of lack of containment. The Soviets have a completely different economic and value system, Denton explained. The Western style containment buildings are millions of cubic feet, while the Soviets are still using their first reactor design, which they can build easily. But the Soviets have never sold a plant outside the Soviet Union with a style like Chernobyl. They sold a plant to Finland, but Finland wanted a containment building like the U.S., so Westinghouse built them one. Now, the plant is known in NRC circles as "Eastinghouse."

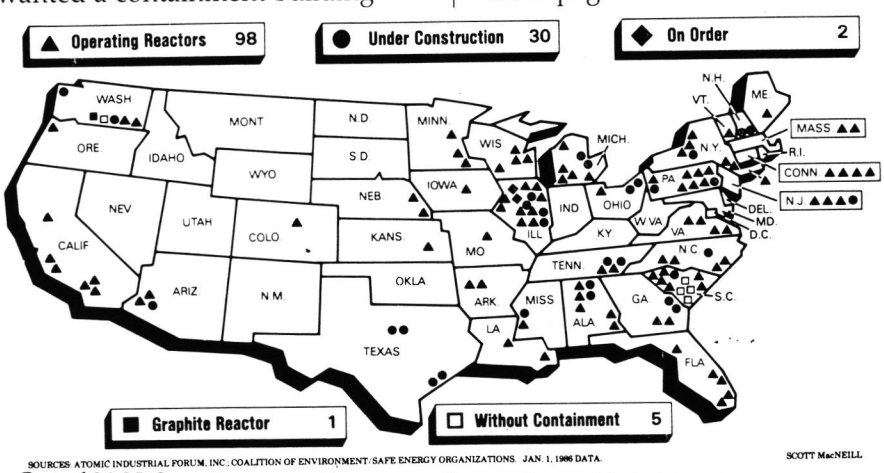
"You can drive a car without brakes if you drive it very carefully," Denton said as an analogy to the Soviet reactor design philosophy; that is what the Soviets have been doing, and they were doing okay until now.

NUCLEAR POWER IN THE FUTURE

The United States is a country blessed with large reserves of coal and natural gas, so there is little pressure for us to go all the way with nuclear power. The people need electricity and it will be generated from both coal and uranium. As Denton said, the utility companies do not want to "put all their eggs in one basket".

Twenty more plants are to be licensed in the next few years. But no new plants are up for licensing, in fact, in 1978, the last plant was proposed. The demand for electricity seems to have gone down—in every branch of electric generation, there are too many plants for the market.

Nuclear power is a safe efficient energy (when the regulations are followed), that does not drain our natural resources. But the industry is crippled by politics and the American public's fear of anything "nuclear." Why is it that one person dies every other day in an accident at a coal mine, but the few accidents at nuclear power plants are the ones that appear on the front page?



Out of 98 U.S. reators operating currently, one is an old- fashioned graphite reactor and five do not have containment buildings. The Chernobyl plant was both graphite and had no containment. Courtesy of Newsweek.

Rain of Trouble: Acid Rain Menaces the Environment

by April Stokes

"HAVE you ever seen the aftermath of a forest fire? The color black is the order of the day with charred trees and exposed top soil. And the silence, the silence of an empty, abandoned forest, once home to many mammals, fishes, and birds. These images can just as easily be brought about by acid rain.

The impact of acid rain on the environment has become a very controversial issue over recent years. Scientists disagree as to what the origins, causes, and effects of acid rain may be. Regions throughout the country most affected by acid rain are pushing for new legislation to mandate major curtailment of acid rain emissions. Coal-producing states are vehemently opposed to this because of the economical hardships that a control would produce. The one proposal that everyone seems to agree on is the need for more scientific research into the causes and effects of acid rain.

WHAT IS ACID RAIN?

Acid rain is the term applied to a form of air pollution resulting from the mixture of certain chemical emissions and atmospheric moisture. Major sources of acid rain are thought to be the coal-burning electric utilities plants using high-sulfur coal. This coal emits high levels of sulfuric dioxide. Coal from the Midwest and Appalachia, where many miners are presently unemployed, tends to contain more sulfur than coal produced in the west. In the eastern United States, acid rain is said to be in these approximate proportions: 60 percent acid sulfates, 30 percent acid nitrates, and 10 percent acid chlorides.

ACID IN THE AIR, ECOSYSTEM, AND THE COMMUNITY

The National Research Council, an arm of the National Academy of Sciences, released a 500-page report last March which concluded that there is no longer any question that emissions of sulfur dioxide produce acid rain and that acid rain harms the environment.

"The one proposal that everyone seems to agree on is the need for more scientific research into the causes and effects of acid rain."

The NRC scientists contrasted long-term trends in plant emissions to the amount of sulfates in the air and the acidity of 32 streams and 626 lakes in the northeastern United States and Canada. The report concluded that there is a cause-and-effect relationship between sulfur dioxide emissions and [the amount of acid-producing] sulfates in the waters.

National Resources Institute, a private think-tank in Washington, DC have produced data on a study of forest decline in the southern Appalachian Mountains. According to Robert Bruck, plant pathologist and forester from the North Carolina State University, North Carolina's Mount Mitchell, the highest peak in the eastern United States, is undergoing an extremely rapid advance in defoliation among red spruce. In 1984, 78 percent of the trees were less than 10 percent defoliated. In the same year, tree mortality went up 7 percent from less than 1 percent. These elevations are subjected to prolonged exposure to mist and stagnant clouds. No direct cause-and-effect relationship with acid rain was determined.

At this time, there are about 200 acidic lakes without any fish population in the US—all of them in the Adirondack Mountain region of New York. No one knows whether or not this acidity is linked to acid rain. One recent study in this area was performed in Canada. Scientists added sulfuric acid to a small lake in northwestern Ontario to document the effects of increasing acidity levels on a lake ecosystem.

Signs like this are unfortunately becoming more common as the problem of acid rain intensifies. About 200 lakes in the Adirondack Mountain of New York are now totally devoid of fish. Courtesy of Science Digest.

President Ronald Reagan and Canadian Prime Minister Brian Mulroney have agreed that the United States needs to begin research to control sulfur emissions. Courtesy of Time.

The lake's pH went from 6.8 to 5.0. Changes in the ecosystem included:
1. Lake-bottom dwelling crustaceans disappeared.
2. The amount of phytoplankton (a tiny, free-floating plant) species decreased.
3. The lake's food web was altered.
4. Fish reproduction was totally stopped.

Ecosystem changes that occurred that were surprising included:
1. No sign of a decrease in the nutrient concentrations, decomposition rates, or overall productivity of green plants.
2. Irreversible ecosystem changes didn't begin until the pH level reached 5.8.

THE HISTORY OF AIR POLLUTION LEGISLATION

Air pollution was long considered a local, or at most, state problem. After World War II, questions of air quality increasingly became seen as interstate issues. Despite a growing political concern over the environment during the 1960's, the role of the Federal Government was largely limited to research and development. As scientific understanding of air pollution increased and the quality of the Nation's air appeared to worsen, efforts to protect public health culminated in the enactment of the Clean Air Act of 1970.

The basic structure of the Clean Air Act is expressed in seven provisions. These are:
1. National Ambient Quality Standards, which establish limits on pollution levels in the air;
2. National Emission Standards, to control hazardous air pollutants;
3. State Implementation Plans, containing the pollution cleanup programs for each State;
4. New Source Performance Standards, imposing technology-based control emission requirements on new stationary sources of pollution;
5. Statutory Mobile Source Control, restricting emissions from motor vehicles;
6. Prevention of Significant Deterioration, to prevent deterioration of clean air in some areas of higher pollution levels; and
7. Limitations on New Emissions in Non-Attainment Areas, where limits on the National Ambient Quality Standards are not being met.

THE POSITION OF THE REAGAN ADMINISTRATION: THEN AND NOW

When Ronald Reagan first took office, he did not acknowledge that man-made pollutants cause acid rain. In a meeting a year and a half ago with Canadian Prime Minister Brian Mulroney, Reagan rejected requests for US action. Last January, though, a joint report on acid rain was issued by former US Secretary of Transportation Drew Lewis and former Ontario premier William Davis. The report recommended that the United States government and industry spend $5 billion to develop new technologies to control sulfur emissions. The President endorsed this recommendation at his summit meeting last March with Mulroney. A possible reason for Reagan's change of heart could be the effective lobbying of Canada's case by former White House aide, Michael K. Deaver.

EPA LITIGATION

Northeastern states and environmental groups are using the courts to try and get the Environmental Protection Agency and Congress to regulate acid rain. Last December, several states and environmental groups filed suit against the EPA, calling for tighter federal air standards on sulfur-related compounds that contribute to acid rain. The suit is the latest of several that have been brought against the EPA to clamp down on sulfur emissions for midwestern industry. Under the Clean Air Act, the EPA was suppose to review and deduce whether to modify standards on air quality in 1980. The last time the EPA issued limits on sulfur oxides was in 1973. The charges were brought by the Environmental Defense Fund, the National Resources Defense Council, Sierra Club, and the states of New York, Vermont, Minnesota, Massachusetts, and others.

WHAT'S BEST FOR THE NATION?

The specific damage acid rain can do is still being studied. Scientists agree, though, that the damage is there, and it is irreversible. At the moment, laws to limit and control air pollution are the most effective deterrent. Unfortunately, the lack of scientific proof of the damage done specifically by acid rain to the environment, makes the move for tighter standards a hard line to sell. What is needed is funding for research. Unfortunately, with the Gramm-Rudman-Hollings deficit legislation adopted by Congress, finding a source for that funding may be extremely difficult.

"WARNING . . . KEEP OUT!": Storing and Disposing of Hazardous Wastes

by Swati Patel and Lilimar Z. Avelino

"ANOTHER Hazardous Waste Leak outside of a small, remote town in the central U.S.A. The entire city has been evacuated—officials at this point have no idea how this tragedy has occurred...."

Sound familiar? Almost every day, we hear of such disasters as hazardous waste leaks, chemical spills, air and noise pollution, etc... In reality, however, water areas around this country are contaminated with such wastes. A major river cutting through the east central U.S., for example, is disrupted by agricultural practices, sewage, ground pollution, toxic rain, and industrial pipelines. This "contaminated river" is in Minnesota's North Clearwater County near Sauk Rapids. These waters contain certain electrical components, which in turn partially consist of chemical PCBs. In our food chain, PCB enters small fishes that predators eat. For each step up in the chain, PCB concentrations grow, until at the end of the chain, they may cause liver damage or cancer to animals or human beings. Because of this, consumption of fish from certain rivers is sometimes banned for a given period of time.

Many other places along the Mississippi also contribute to the poisoning of the river. Near Minneapolis, farm run-off carries fertilizers and pesticides to the river, while toxic water from metal plating industries and battery manufacturers worsen the pollution. In addition, surrounding lakes are threatened by mercury contamination from the soil and acid rain.

Another major concern is sewage systems. Fourteen wastewater treatment plants along the Mississippi discharged 276 million gallons *daily* into the river. The Wisconsin Department of Natural Resources has also found a molecule called **furin**, which is just as toxic as dioxin. It is created by industrial processes, and it usually accompanies PCB. Furthermore, 42 sites along the Mississippi have a problem with dioxin contamination. New Orleans has a higher cancer rate due to some contaminated water; while the state of Louisiana has oil-field pits spilling into swamps and pastureland along its river's course.

"HEARING often of such incidents sometimes makes us insensitive to the real safety measures being taken against environmental hazards. But who takes such precautions for our safety?

Chemical and environmental engineers are always attempting to minimize such tragedies by taking every safety precaution possible. For instance, when interviewing Thomas H. Woo, an experienced environmental coordinator working at Naval Ordinance Station (Indian Head, Maryland), we discovered many of the following tasks being performed daily, including:

—tests and studies of possible new contaminants;

—proper classification of harmful materials as hazardous wastes;

—accurate labeling and storing of hazardous materials;

.—monitoring of air and noise pollution;

This devastated forest, known as "Inger Oil Site," resulted from its use as a hazardous waste site for the now defunct refinery. Courtesy of Science Digest.

This skull is the remains of one of Dave Ewell's cattle that was killed by chemical contamination of his Louisiana Ranch when the river overflowed. Courtesy of Science Digest.

—purifying potable water by physical and chemical means.

GENERAL CHARACTERISTICS OF HAZARDOUS WASTES

When interviewing Mr. Woo, we discovered that classifying harmful substances as hazardous wastes is the first step towards cleaning up the environment. Declaring hazardous wastes, however, requires common catagories. Thus, the four characteristics constituting hazardous waste are ignitability, corrosivity, reactivity, and Environmental Protection (EP) toxicity.

A solid waste exhibits the characteristics of ignitability if a representative sample of the waste has any of the following properties: If it's a liquid, will have less than 24 percent alcohol by volume after several standard tests. If it is not a liquid, the material will be tested to see if it will cause fire through friction or absorption of moisture; that is, if a substance burns vigorously when ignited, it can cause a hazard.

A corrosive waste, on the other hand, has a pH of less than or equal to 2 or greater than or equal to 12.5. It could also be a liquid that corrodes steel at a rate greater than 6.25 inches per year at 130 degrees Farenheit.

A substance possesses the property of reactivity if it undergoes violent changes when ignited. In reactions with water, it generates toxic gases or forms potentially explosive mixtures. This can present a clear danger to human health and the environment.

The last characteristic, EP toxicity, is measured for a given waste sample, against levels specified by the Environmental Protection Agency. If the sample contains a contaminant at a concentration greater than that permitted by the agency, it is declared hazardous. For example, the maximum allowable conentration of arsenic in a sample is 5 milligrams per liter.

After the harmful substance has been declared a hazardous waste, separate measures must be taken in storing and labeling the waste. Of course storage of such contaminants must be in proper containers such as safe steel drums (free of rust and corrosion), . Correct labeling should describe the characteristic of the hazardous waste (one of the four listed above), type of contaminant, and storage temperature directions.

MONITORING AIR POLLUTION

Another familiar problem in most industrial cities is air pollution. The most common air pollutants are carbon monoxide (CO), ozone, and sulfur dioxide.

Carbon monoxide is mainly caused by the incomplete combustion of fossil fuels. Binding readily into hemoglobin, found in human blood, it can disrupt oxygen supply to the tissues. Heavy pollution can even be fatal to coronary patients.

Ozone is formed when ultraviolet radiation from the sun causes very involved reactions with pollutants. In the respiratory tract, it can damage cells, causing pain, inflammation, or constriction of the lungs.

Mexico City, in particular, has one of the foulest and thinnest air regions in the world. There, 130, 000 factories spew approximately 114 tons of gas into the air every day. These sources of pollution can weaken the sick and hurt the performance of the healthy. However, in the United States, in order to test if such places stay within the rules of federal, state, and local health regulations, environmental engineers like Thomas Woo must check the air monitors every six days. They look for particulates that could "poison" the air.

PURIFYING POTABLE WATER

In addition to cleaning the air, environmentalists help rid our water of unsafe materials. For example, one of the tasks of Mr. Woo is to assure the quality of drinking water under the authority of Safe Drinking Water Act. He tests for bacterial or chemical contamination due to such contaminants as heavy metals. He performs daily checks on chlorine and monthly bacteria checks.

Another concern is the problem of water in corroded pipes with high levels of dissolved iron and manganese. Corrosion is usually caused by low pH (acidity), so special filters that feed high pH solutions into the water are used by environmental specialists like Mr. Woo to neutralize the acidity. Special chemicals, like silicates are also fed into the water to form protective films on metal plates, thus producing safe drinking water.

CLEANING UP THE ENVIRONMENT

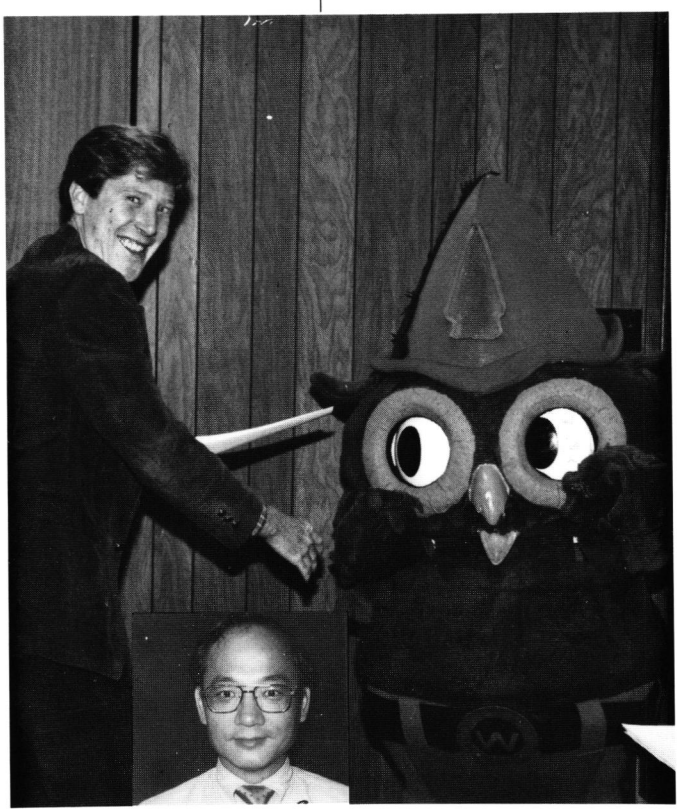
Specifically, Mr. Woo has recently followed through several major projects aimed at undoing the damage caused by environmental hazards. For example, the USE (Used Solvent Elimination) project attempts to find substitutes for solvents (like acetone, toluene, and perchloroethylene) dangerous to our health.

Another breakthrough has been brought about by the change from wet paint stripping to dry plastic medium stripping. Wet chemical stripping contains approximately 50 percent methylene chloride, a toxic chemical. Mr. Woo has attempted to eliminate sludge and contaminated water from paint stripping. Specifically plastic medium paint stripping eliminates the stripper itself, the contaminated wastewater and contaminated paint sludge.

Use of the Digital Radiograph constitutes a third successful development by Thomas Woo and the Naval Ordinance Station. Real-time (digital) X-rays instead of conventional ones check the quality and structural integrity of rocket propellants, a product of NOS.

"ACHIEVEMENTS such as these help ensure the safety of out society. Biologists, as well as environmentalists, in the future, hope to understand the effect of contaminants and the level at which they destroy enzymes, inhibit cellular energy production, and cause genetic mutations.

Attempting to make the world we live in less toxic is the ultimate goal of environmentalists, who inform the public and prevent more pollution from poisoning our rivers, land, and atmosphere. Environmental coordinators like Thomas Woo are most dedicated and are expertly qualified to achieve this goal.



In his spare time, Dr. Thomas Woo dresses up as Woody Owl to carry to people the message of saving the environment. "Give a hoot, don't pollute!" Courtesy of Dr. Woo.

Check Over Your Resumes:
Campus Interviewing Brings Promise of Lucrative Jobs

by Daniel L. Briller

"SO, you want a good job after graduation? Before you race to the want ads, why not start out closer to home. In just a few weeks, campus interviewing will begin, and now is the time to get ready. In anticipation, we spoke with Anne Marie Alexander and Anne Scammon of the Career Services Center, which sponsors the interviewing process. While this article is intended as an introduction to some facets of campus interviewing, students seeking more information should visit CSC on the fifth floor of the academic center.

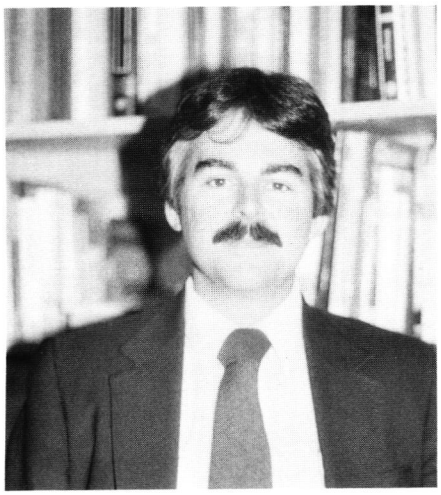
Mecheleciv: What is the procedure a student should follow in order to set up a campus interview?
Anne Marie Alexander: Students are referred to pages 8-10 of the *Guide to Career Services*, which can be obtained at the Career Services Center. First, one must set up a credential file, which involves filling out a simple form and giving us twenty copies of his/her resume (a $20 fee is also required for processing). The resumes are given to the recruiter the day he/she comes. After setting up a file, the student should come in every other Monday (the dates are in the Guide) and pick up a Campus interviewing bulletin. This will list who's coming, what they're looking for, i.e. position, degree, location hiring for, etc., for two weeks worth of interviews. The student has four days after the schedule comes out to submit a request form for a campus interview. Students and recruiters are matched randomly by a computerized matching system solely on the basis of degree, major, and citizenship requirements—not by GPA, prior experience, or any other factors. There's no first come, first served or anything like that, either.

"Work experience is what really sets a student apart whether through part-time jobs, co-op programs, or internships."

Mecheleciv: You mentioned a credential file. What does that normally contain?
Anne Marie Alexander: It's the student's option what he/she wants to put into the file. You have to have the resumes. More and more firms are requesting transcripts. It may also contain letters of recommendation. A credential file is really a supporting file. At the end of an interviewing day, the recruiter may ask to see a particular student's file. A note: when students give us material for the file, they automatically give us the right to hand it out.
Mecheleciv: How should a student prepare for an interview?
Anne Marie Alexander: Some of the main ways include going to CSC workshops on resume writing, job search strategy, and interviewing. Read the organization's literature, most of which can be obtained either at CSC or at the Gelman Library. An interviewer *knows* when a student has done his/her homework. As much as possible, the student also must know what he/she is looking for. Firms usually come looking to hire for a specific position. Pay attention to the Bulletin to see what positions the company is hiring for. Our career consultants can help students define their career goals—what they really want to do. People in the field can help with this, too.

Mecheleciv: How can students improve their interviewing techniques?
Anne Marie Alexander: First, attend one of CSC's interviewing workshops. Afterwards, we can do mock interviews, which are recorded on videotape for studying later on. Remember that these recruiters are well-trained and used to seeing a lot of students. Also see the article on pg.43 of the *Guide* entitled "Steps for Successful Interviewing."
Mecheleciv: What action is recommended after an interview?
Anne Marie Alexander: Definitely a thank-you note. A thank-you note does two things: it's polite and it also reminds the interviewer that you're interested. If there's something you forgot to say in the interview, a special course you took or a paper you wrote, for example, it gives you another chance to express that. It can make you stand out over everybody else. Sample thank-you letters are in the Guide, pg. 29-34.
Anne Scammon: Remember the most important thing is to appear professional. Recruiters want to see if you can make the transition from being a student to being an employee. A neat, articulate letter in business format can help convince them you're a mature, responsible individual.
Mecheleciv: What qualities, other than technical competence, are recruiters looking for?
Anne Marie Alexander: Communication skills, i.e. speaking and writing, are very desirable. Extracurricular activities can help show you're a well-rounded person. Leadership experience, i.e. serving in student government or being the leader of a club, and the willingness to work hard are also things recruiters look at. Work experience, though, is what really sets many of our students apart, whether through part-time jobs, co-op programs, or internships.

"The Career Services Center posts 111, 000 full-time job listings a year."



Ken Everingham, Careers Services' Liaison to the Engineering School is always willing to speak with engineers about their career goals.

Mecheleciv: Have you noticed any discernable difference between the approaches of private corporations, as opposed to those of the government and military?
Anne Scammon: The approach of people coming from these different sectors usually reflects the differences between the sectors, themselves. It can be much more aggressive in a corporation, money is much more important to them, and students should be cognizant of this. One cannot approach interviewers from the different sectors in exactly the same way—they're just different animals.
Mecheleciv: What other job search strategies exist, outside of campus interviewing?
Anne Marie Alexander: The students who get the best jobs are the ones who try *every* job search strategy. We post 111,000 full-time job listings a year. We have a JOBLINE telephone (676-8636) students can call to get descriptions of different positions in the field. Wednesdays and Thursdays are devoted specifically to engineering jobs.
Mecheleciv: What other services does CSC provide during the semester?
Anne-Marie Alexander: We've already talked about some of our workshops: on resume writing, interviewing, etc. We also have resume critiquing services, where you can drop your resume off, have it evaluated, and pick it up two days later. You can sit down one-to-one with one of our career consultants and go over your resume, or talk to the liaison for the engineering school, Ken Everingham (be sure to make an appointment first!). We have a lot of literature, not just about companies, but about the profession, in general. I'd also like to emphasize that every year, in the spring, we sponsor a "Career Week." This full week of activity includes employer open houses and a Career Fair. This year, Career Fair will be on Feb.4, 1987, 4-7 PM. Anyone from a freshman to a alumnus can come and talk to representatives from various organizations about what's going on in the field.
Mecheleciv: What advice would you give to our international students?
Anne-Marie Alexander: It is true that many employers come on campus looking to hire U.S. citizens only. This doesn't mean there aren't opportunities open to them. All international students should check the recruiting schedule first, just to make sure. They can also speak to career consultants who can help them assess the opportunities open to them.
Mecheleciv: This has been very informative. Thank you.

Anne Marie Alexander, Employer Relations Coordinator for Career Services, is the person to speak to about all aspects of campus interviewing.

Bikes, Boats, and Music: They Make the CAD/CAM Run

WHAT could motorcycles, sailboats and folk music have in common with a DEC VAX or an IBM CAD/CAM system?

Well, meet Rich Stoler, Jeyanathan, and John Kelso. Allare systems engineers whom many of you have seen working in the School of Engineering and Applied Science Computing Center in Tompkins Hall. Their hobbies are sailing, motorcycling, and folk music respectively.

These three bearded men are responsible for making sure the operating systems in the Computing Center are functioning and maintained, as well as installing new software and hardware.

Rich Stoler, the senior systems programmer, came here almost two years ago after his wife was hired at Georgetown University as director of academic computing. Their decision to move to the Washington area was determined as much by the availability of top notch sailing on the Chesapeake Bay as by the job offers they recieved.

Rich started his career in computers when he was an undergraduate in the 1960's. As an anthropology/archeology student at SUNY-Binghamton, he, "saw the need to replace things done by hand to be done by computers, especially map making of archeological sites." He went on to develop the use of computers for site prediction for archeological digs as a graduate student at Syracuse University. He was also one of the first people to use computers in field artillery, while serving in the army. Prior to coming to GWU-SEAS, Rich was the VAX systems manager at Lamoine College in Syracuse, N.Y.

His responsibilities at the computing center include keeping the IBM system running and installing most of the new software products, of which there are between 40-50 on the IBM system.

These three bearded men (Rich Stoler, Jeyanathan and John Kelso) are responsible for maintaining the operating systems at the Computing Center, as well as installing new software and hardware.

Jeyanathan or Jey is the oldest (not in age but in time served) employee in the computing center. He came here as an undergraduate student from Kuala Lampur, Malaysia. Jey started out as in electrical engineering but later switched his major to computer engineering. He is presently studying for his Masters degree in computer science.

Jey started working at the SEAS computing facility five years ago. Beginning as an operator or "super TA", he then over time moved up until a position of systems programmer opened up.

Presently, Jey's work involves primarily networking of the various systems, making them capable of communicating with each other, as well as overseeing other networks such as BITNET, which is a communications system including some 6000 research institutes throughout the world. He has also been busy lately setting up the new SUN system. Besides all that, he is also the VAX systems manager.

John Kelso, married and a native Washingtonian, started working at GWU one and a half years ago, after being employed for ten years as a government consultant. John worked on such diverse projects as writing the computer program for a weather satellite and measuring seismic distrubances as part of arms control verification.

After graduating from the University of North Carolina at Chapel Hill, John came back to Washington and earned a masters degree, which emphasized computer graphics, from GWU. He got into computer work after he decided he didn't want to teach high school math.

John's responsibilites in the computing center focus on the graphics packages. These include the IBM 5080 graphics work stations and the SUN graphics system. Besides installing the software and/or hardware necessary he also debugs the system, so it will work.

—Jeff Winbourne

New Research-Teaching Facility Planned For Northern Virginia

by Jeff Winbourne and Il H. Kim

A BOLD, futuristic plan which is designed to bring the School of Engineering and Applied Science into the 1990's as a leader in its field, has recently been announced. Calling for the building of a graduate level research and instruction facility in Northern Virginia, the plan will include the establishment of a joint university-industry partnership.

The center initially will require erecting about 75,000 square feet of classrooms, providing research and support services for 500 students, and hiring 20 additional full-time staff members.

The focus of the new center will be research on the graduate level. Currently, facilities at the intown campus are strained, with little room to expand. With over 2,500 graduate students both on and off campus and 1,000 undergraduates this problem is highlighted. The Virginia facility will allow for an expansion of the avaliable research resources and bring in more research grants to the university. The grants are needed to support graduate studies and graduate students. At this time, GWU-SEAS is involved in about $7 million of research work, annually.

Stressing the role of research to the engineering school, Dean Harold Liebowitz pointed out, "It is very important to have research for graduate school. It also helps the undergraduate school as well. Anything we can do to have greater accessibility to research or to offer students greater research opportunities will only enhance the value of the academic program." He continued, "The effect on undergraduate school is as follows. If you are strong in graduate programs, it will spill over into the undergraduate studies. Having faculty who have just performed research or design engineering, and have up-to-date results, come into the classroom is much more stimulating and motivating for the students. So it is very important that the emphasis at the Virginia site be on research."

Dean Harold Liebowitz (left) stated that universities today should 'couple' with industry and government in order to be at the forefront of technology. Courtesy of Dean Liebowitz.

One of the unique features of the new center will be the attempt to actively join forces with industry in carrying out the research and instruction. Dean Liebowitz went on to point out, "No university today can afford the equipment or experimental apparatus necessary to have a program placed at the forefront of technology. In order to achieve the appropriate mix, we should 'couple' with industry and government." Liebowitz pointed to the example of the JIAFS, Joint Institute for the Advancement of Flight Science carried out with NASA at Langley, Virginia. Here top quality students (3.6-4.0 GPA) who spend half their time working with the NASA scientists on projects and the other half in class, where some NASA scientists also work as GWU faculty. This project was initiated by Dean Liebowitz and has been in existence for 18 years.

The joint industry-university partnership will take the form of the Center for High Technology. Many of the projects students will be working on will be industry-related. Also, some scientists and engineers from industry will be working with the faculty as visiting members at the Center. Furthermore, companies will be encouraged to open offices and laboratories at the site.

A very important contribution of GWU-SEAS will be to provide expertise in many fields needed by industry looking to gain a competitive edge. The University has eight research institutes, among them:

- the Institute for Information Science and Technology;

- the Institute for Artificial Intelligence;
- the Joint Institute for the Advancement of Flight Sciences;
- the Institute for Reliability and Risk Analysis;
- the Institute for Management Science and Engineering;
- the International Water Resources Institute;
- the Institute for the Study of Fatigue, Fracture and Structural Reliability.

The Center for High Technology will utilize each of these existing institutes. "We will not be starting from scratch, but with existing expertise," Liebowitz stated. Furthermore, other departments in the university such as chemistry, physics, mathematics, and statistics have been invited to participate.

In order to open in the fall of 1989, SEAS has begun to search for new faculty members. Liebowitz stated, "we should get a number of people who are the very best in their fields. Our efforts should be recognized not only on a national level but also on an international level," stated Dean Liebowitz.

Partly, this new plan is also a response to the annonunced plans of other universities in this area to expand their engineering instruction and research programs. These include John Hopkins, University of Maryland, and George Mason University.

"The center has to be of the highest quality," continued Liebowitz. "GWU has made significant progress over the past 20 years. Our next phase is to give high priority to the research effort. Now we are in a position to do this because of the excellent work President Elliot has done in assuring us that we have a very good financial base on which to operate."

SEAS News Briefs

- The cooperative education department in the School of Engineering and Applied Science, SEAS, is annually involved with other area 'co-op' schools in honoring participants. Through an organization called National Capitol Area Association for Cooperative Education (NCACE), an employer of the year is chosen. Each college then selects its own student of the year. This year, the department chose Daniel Briller.

Howard Davis, Coordinator of Cooperative Education at SEAS explained that Danny was picked out of 69 other students active in the program. The reasons, Davis said were, "because of his work record, his activities on campus, and his attitude toward co-op." Danny has worked at the Naval Research Lab during his co-oping terms.

The cooperative education program places engineering students in positions with local firms. Besides earning money the students begins to accumulate experience in an engineering work environment.

- The fall semester brings new additions to the SEAS computing center. Eight SUN workstations, three color and five black and white, have been added to the CADCAM lab. The machines have been networked together so students can use any one at any time. They are not minicomputers, but they will be merged with the VAX. The SUN system is a graphical system for designing circuit boards.
- Interested in computing? Willing to try your abilities/luck against some competition? Then you may be interested in the computing team. The team participated in one match last year with local colleges. A knowledge of PASCAL is helpful. If you are interested contact Prof. Shelley Heller in the EE/CS Department, X-5906.
- Students returning for classes have found Tompkins Hall to have a new look. The hall ways have been freshly painted with color strips decorating the walls and new lighting fixtures to brighten up the formerly twilight corridors and stairwells. In addition the first floor has been carpeted. Just what will they do to the old school next?

—Jeff Winbourne

SEAS Students . . . Get involved in the Engineers' Council.

The Engineers' Council is the elected student governing body for the School of Engineering and Applied Science. The purpose of the Council is to provide liaison between the student body of the School and the Faculty, Administration, and the Student Government of the University in all matters affecting the general interests and welfare of the student body, the School, or the University.

The Council sponsors a number of activities for the benefit of engineering students. These include the MECHELECIV magazine, the Annual School Picnic in the Fall, the Engineers' Week and the Engineers' Ball in the Spring. The Council nominates a graduating senior every April for the Norman B. Ames award. In addition, the Council manages the Davis-Hodgkins (D.H.) House at 2142 G St., N.W. (telephone (202) 676-7485) and provides a number of facilities and services (TV lounge, coffee, photocopying, word-processing, reading room, guidance and counseling) for SEAS students. The Council holds elections every March and the new Council takes control in April. The officers for the 1986-1987 sessions are:

President Akbar Khawaja
Vice President Khalid Juhany
Secretary Imran ul Haque
Assistant Secretary Talal Bakhsh
Treasurer Dipo Alam
D.H. House Manager Esteban Hurtado

In Spring '86, Akbar Khawaja, president of the Engineers' Council received the Baer Award of Excellence in Student Life for his outstanding contributions and services to the university community.

LETTERS TO THE EDITOR

To the Editor:

I wish to point out several corrections to the financial aid profile in the "Campus News" section of your recent issue of MECHELECIV. $8 million will be available to GWU through the CONSERN loan program, not $18 million. Second, the administration's budget proposes merging the SEOG and College Work-Study (CWSP) programs, not Pell.

We would appreciate these corrections being noted.

Sincerely,
Laura Donnelly, Associate Director
GWU Office of Financial Aid

Note: *The Editors acknowledge these errors and apologize for any inconvenience they may have caused.*

To the Editor:

I've read (and enjoyed) your articles in the recent edition of MECHELECIV (Volume 33, No.1). In these articles the MacIntos h(by Apple) was raved about as being the best thing since sliced bread in the following areas (respectively):
1. computer graphics/computer generated imagery
2. local networking
3. CAD/CAM

In article 1 the Mac was compared with a Cray Supercomputer for computer graphics. In article 3 the Mac was proclaimed the "latest innovative graphics-oriented computer in the micro area." In article 2 the Mac was attributed as being the major exception in the area of PC networking since it does not require a network converter board to operate on an Appletalk network. From my perspective the Mac is one of the least suitable PCs for use in graphics or networking applications. For graphics it is horrendously slow, the screen is extremely small, it has only black and white (I know a new color model is coming, but it is also slow), it does not have the capability for accepting video processing cards. In short, it is one of the worst candidates I can think of and certainly not the "latest innovative graphics oriented computer in the micro area." The AMIGA PC is easily orders of magnitude better than the Mac in the area of graphics.

With respect to LAN applications it is well known that Appletalk was a miserable failure. Again in this area the Mac has fundamental limitations. Almost any PC can operate a network through an 129-232 port at the sacrifice of very poor performance.

The Mac is no exception to this. It does not have an Ethernet card (which can operate at 10 mbps) because it cannot accept plug in cards. It is not the other way around (i.e., a card is not used because it is not needed).

In terms of CAD/CAM I'd suggest that Mr. White look into the PCLO CAD package by SoftCircuits (305) 721-2707 and Aegis Draw Pro CAD package (213) 306-0735. I believe you will find that these packages running on the AMIGA will easily surpass anything the Mac is theoretically capable of doing (including efficient multi-tasking).

Regards,
John Andiyahi
GW student

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